WE CLAIM

1. An add-drop multiplexer, comprising:

an optical transmission signal input port adapted to receive a wavelength division multiplexed optical transmission signal;

an optical transmission signal output port adapted to output at least a portion of said wavelength division multiplexed optical transmission signal;

an add-drop optical channel port adapted to receive an optical add channel and output an optical drop channel; and

a wavelength selective optical filter arranged between said optical transmission signal input port, said optical transmission signal output port and said optical add-drop channel port,

wherein said wavelength selective optical filter reflects an optical channel that will continue through said add-drop multiplexer along a transmission line to said optical transmission signal output port and permits an optical channel that is to be dropped to pass therethrough.

2. The add-drop multiplexer as recited in claim 1 further comprising:

a wavelength tracker and stabilizer in optical communication with said wavelength selective optical filter.

3. The add-drop multiplexer as recited in claim 2,

wherein said wavelength tracker and stabilizer comprises an optical channel monitor having an absolute wavelength reference, said optical channel monitor providing absolute wavelength and intensity information of the optical channel reflected by said wavelength selective optical filter.

4. The add-drop multiplexer as recited in claim 1,

further comprising an optical coupler in optical communication with said optical transmission signal input port and said wavelength selective optical filter.

5. The add-drop multiplexer as recited in claim 4,

wherein said optical coupler is an optical circulator having a first optical port in communication with said optical transmission signal input port, a second optical port in

communication with said wavelength selective optical filter, a third optical port in communication with said add-drop optical channel port.

6. The add-drop multiplexer as recited in claim 1,

wherein said wavelength selective optical filter comprises an optical fiber having a fiber Bragg grating therein, said fiber Bragg grating having a reflecting band corresponding to an optical channel permitted to pass through said add-drop multiplexer.

7. The add-drop multiplexer as recited in claim 6,

wherein said wavelength selective optical filter further comprises a tuning element disposed proximate to said fiber Bragg grating.

8. The add-drop multiplexer as recited in claim 7,

wherein said tuning element comprises a mechanical strain element attached to said optical fiber that has said fiber Bragg grating.

9. The add-drop multiplexer as recited in claim 7,

wherein said tuning element comprises a thermal element in thermal contact with said fiber Bragg grating.

10. The add-drop multiplexer as recited in claim 1,

wherein said wavelength selective filter comprises an optical fiber having a plurality of fiber Bragg gratings therein arranged in series, at least one of the fiber Bragg gratings having a transmission characteristic different from a transmission characteristic of a second one of the fiber Bragg gratings.

11. The add-drop multiplexer as recited in claim 1,

wherein said wavelength selective filter comprises a plurality of optical fibers, each comprising a fiber Bragg grating, and

wherein said wavelength selective filter comprises an optical multiplexer in communication with said optical signal input port and said plurality of optical fibers, the plurality of optical fibers, each having a fiber Bragg grating, being arranged in parallel.

12. The add-drop multiplexer as recited in claim 1, further comprising an interleaver disposed between said optical transmission signal input port and said wavelength selective optical filter, said interleaver adapted to split an optical signal from said optical signal input port into a plurality of optical signals to be directed to said wavelength selective filter.

13. The add-drop multiplexer as recited in claim 1, further comprising an optical amplifier and channel equalizer in communication with said wavelength selective optical filter and said optical transmission signal output port.

14. A method of adding and/or dropping an optical channel in a wavelength division multiplexed system, comprising:

directing a wavelength division multiplexed optical signal to a wavelength selective filter, said wavelength selective filter having a higher reflectivity for a first optical channel of said wavelength division multiplexed optical signal compared to a second optical channel of said wavelength division multiplexed optical signal;

filtering said wavelength division multiplexed signal with said wavelength selective filter to produce a through channel substantially at a wavelength of said first optical channel and a drop channel substantially at a wavelength of said second optical channel;

directing said through channel into a transmission path of said wavelength division multiplexed system and allowing said drop channel to pass therethrough,

wherein said through channel is reflected by said wavelength selective filter to continue along a wavelength division multiplexed transmission path of said wavelength division multiplexed system.

15. The method of adding and/or dropping an optical channel in a wavelength division multiplexed system as recited in claim 14, further comprising:

directing an add channel into said transmission path along with said through channel,

wherein said add channel is at substantially a same wavelength as a wavelength of said drop channel.

16. The method of adding and/or dropping an optical channel in a wavelength division multiplexed system as recited in claim 14,

wherein said filtering comprises selecting a wavelength with a wavelength selective filter comprising a fiber Bragg grating.

17. The method of adding and/or dropping an optical channel in a wavelength division multiplexed system as recited in claim 14, further comprising:

monitoring said through channel with a wavelength tracker and stabilizer comprising an absolute wavelength reference.

18. The method of adding and/or dropping an optical channel in a wavelength division multiplexed system as recited in claim 17,

wherein said monitoring comprises determining absolute wavelength and intensity information of light reflected with said wavelength selective filter.

19. The method of adding and/or dropping an optical channel in a wavelength division multiplexed system as recited in claim 17,

wherein said monitoring further comprises providing feedback to a tuning element disposed proximate said wavelength selective filter.

20. The method of adding and/or dropping an optical channel in a wavelength division multiplexed system as recited in claim 14,

wherein said filtering reflects a plurality of optical channels to continue along a wavelength division multiplexed transmission path of said wavelength division multiplexed system.

21. The method of adding and/or dropping an optical channel in a wavelength division multiplexed system as recited in claim 20, further comprising equalizing a relative strength between at least two of said plurality of optical channels reflected in said filtering.

22. The method of adding and/or dropping an optical channel in a wavelength division multiplexed system as recited in claim 14, further comprising amplifying said through channel.

23. A dynamically reconfigurable add-drop multiplexer, comprising:

an optical signal input port;

a tunable band-reflecting optical filter in optical communication with said optical signal input port;

a wavelength tracker and stabilizer in optical communication with a reflected light path from said tunable band-reflecting optical filter,

wherein said wavelength tracker and stabilizer comprises an optical channel monitor comprising an absolute wavelength and intensity reference, said wavelength tracker providing absolute wavelength and intensity information of light reflected by said tunable reflecting optical filter.

24. The dynamically reconfigurable add-drop multiplexer as recited in claim 23, wherein said band-reflecting optical filter reflects a wavelength channel to be sent as a through channel into said reflected light path and transmits a wavelength channel to be dropped.

25. The dynamically reconfigurable add-drop multiplexer as recited in claim 23, wherein said band-reflecting optical filter comprises a fiber Bragg grating.

26. The dynamically reconfigurable add-drop multiplexer as recited in claim 23, wherein said wavelength tracker and stabilizer comprises a mechanical strain varying assembly.

27. The dynamically reconfigurable add-drop multiplexer as recited in claim 23, wherein said wavelength tracker and stabilizer comprises a temperature varying assembly.

28. The dynamically reconfigurable add-drop multiplexer as recited in claim 23, further comprising:

an add channel input port in communication with said reflected light path from said tunable band-reflecting optical filter.

29. The dynamically reconfigurable add-drop multiplexer as recited in claim 23, further comprising:

an optical amplifier in communication with said output optical signal.

30. The dynamically reconfigurable add-drop multiplexer as recited in claim 29, further comprising:

a channel equalizer in communication with said output optical signal.

31. A wavelength division multiplexed optical communication system, comprising:

a plurality of transmitters;

an add-drop multiplexer in communication with said plurality of transmitters;

an optical transmission line in communication with said add-drop multiplexer;

an optical demultiplexer in communication with the optical transmission line; and

a plurality of receivers in communication with the optical demultiplexer;

wherein said add-drop multiplexer comprises:

an optical transmission signal input port adapted to receive a wavelength division multiplexed optical transmission signal;

an optical transmission signal output port adapted to output at least a portion of said wavelength division multiplexed optical transmission signal;

an add-drop optical channel port adapted to receive an optical add channel and output an optical drop channel; and

a wavelength selective optical filter arranged between said optical transmission signal input port, said optical transmission signal output port and said optical add-drop channel port,

wherein said wavelength selective optical filter reflects optical channels that will continue through said add-drop multiplexer along a transmission line to said optical transmission signal output port and permits an optical channel that is to be dropped to pass therethrough.

32. The wavelength division multiplexed optical communication system as recited in claim 31,

wherein said add-drop multiplexer further comprises a wavelength tracker and stabilizer in optical communication with said wavelength selective optical filter.

33. The wavelength division multiplexed optical communication system as recited in claim 32,

wherein said wavelength tracker and stabilizer comprises an optical channel monitor

comprising an absolute wavelength reference, said optical channel monitor providing absolute wavelength and intensity reference, said wavelength tracker providing absolute wavelength and intensity information of light reflected by said tunable reflecting optical filter.

34. The wavelength division multiplexed optical communication system as recited in claim 31,

wherein said wavelength selective optical filter comprises an optical fiber having a fiber Bragg grating therein, said fiber Bragg grating having a reflecting band corresponding to an optical channel permitted to pass through said add-drop multiplexer.

35. The wavelength division multiplexed optical communication system as recited in claim 34,

wherein said wavelength selective optical filter further comprises a tuning element disposed proximate said fiber Bragg grating .

36. The wavelength division multiplexed optical communication system as recited in claim 35,

wherein said tuning element comprises a mechanical strain varying assembly attached to said optical fiber that has said fiber Bragg grating.

37. The wavelength division multiplexed optical communication system as recited in claim 35,

wherein said tuning element comprises a temperature varying assembly in thermal contact with said fiber Bragg grating.

38. The wavelength division multiplexed optical communication system as recited in claim 35,

wherein said wavelength selective filter comprises an optical fiber having a plurality of fiber Bragg gratings therein arranged in series, at least one of the fiber Bragg gratings having a transmission characteristic different from a transmission characteristic of a second one of the fiber Bragg gratings.

39. The wavelength division multiplexed optical communication system as recited in claim 35,

wherein said wavelength selective filter comprises a plurality of optical fibers, each comprising a fiber Bragg grating, and

wherein said wavelength selective filter comprises an optical multiplexer in communication with said optical signal input port and said plurality of optical fibers, the plurality of optical fibers, each having a fiber Bragg grating, being arranged in a parallel.

40. The wavelength division multiplexed optical communication system as recited in claim 35,

wherein said add-drop multiplexer further comprises an interleaver disposed between said optical transmission signal input port and said wavelength selective optical filter, said interleaver adapted to split an optical signal from said optical signal input port into a plurality of optical signals to be directed to said wavelength selective filter.

41. The wavelength division multiplexed optical communication system as recited in claim 35,

wherein said add-drop multiplexer further comprises an optical amplifier and channel equalizer in communication with said wavelength selective optical filter and said optical transmission signal output port.